

## RESEARCH

### Development of an Instrument to Measure Academic Resilience Among Pharmacy Students

Marie A. Chisholm-Burns, PharmD,<sup>a</sup> Christina A. Spivey, PhD,<sup>b</sup> Erin Sherwin, BS,<sup>b</sup> Jennifer Williams, PharmD,<sup>a</sup> Stephanie Phelps, PharmD<sup>a</sup>

<sup>a</sup> University of Tennessee Health Science Center College of Pharmacy, Memphis, Knoxville, and Nashville, Tennessee

<sup>b</sup> University of Tennessee Health Science Center College of Pharmacy, Memphis, Tennessee

Submitted November 30, 2017; accepted March 1, 2018; published August 2019.

**Objective.** To develop a valid and reliable academic resilience scale for use in the didactic portion of the Doctor of Pharmacy curriculum to identify those pharmacy students who have greater capacity to overcome academic adversity.

**Methods.** A cross-sectional survey was conducted among first-year, second-year, and third-year pharmacy students to assess psychometric properties of a 30-item adapted academic resilience scale. Data were also collected using the Short Grit Scale (Grit-S). Demographic characteristics were collected from student records. Exploratory factor analysis was applied to determine the number of underlying factors responsible for data covariation. Principal components analysis was used as the extraction method. Varimax rotation method was used, and the Cronbach alpha was estimated. Validity testing was conducted by calculating Pearson's *r* correlations between the adapted academic resilience scale and Grit-S.

**Results.** The survey response rate was 84%. The final version of the scale, the Academic Pharmacy Resilience Scale (APRS-16), had four subscales and 16 items (14 items failed to load on any of the factors and were deleted). The Cronbach alpha was .84, indicating strong internal consistency. The APRS-16 and its subscales were significantly correlated to the Grit-S and its subscales, providing evidence of effective convergent validity.

**Conclusion.** Evidence supports the reliability and validity of the APRS-16 as a measure of academic resilience in pharmacy students. Future studies should use the APRS-16 to investigate the relationship between academic resilience and performance outcomes among pharmacy students.

**Keywords:** academic resilience, grit, noncognitive traits, scale development, pharmacy students

## INTRODUCTION

Metacognitive or noncognitive skills are defined as “patterns of thought, feelings, and behavior” and include factors such as “self-control, self-regulation, persistence, academic confidence, teamwork, organizational skills, creativity, and communication skills.”<sup>1</sup> Both Accreditation Council for Pharmacy Education (ACPE) Standards 2016 and the Center for the Advancement of Pharmacy Education (CAPE) 2013 Outcomes recognize the value of noncognitive traits, such as self-awareness, leadership, and professionalism, as part of the admissions process and qualities to be developed during Doctor of Pharmacy programs.<sup>2,3</sup> One notable noncognitive factor, resilience

(or academic resilience), has received considerable attention as a possible determinant of student success in classroom and clinical environments.<sup>4-7</sup>

Resilience is an abstract concept that describes a person's ability to overcome or adapt to perceived or real adverse or challenging circumstances. More specifically, the concept of academic resilience is defined as “a capacity to overcome acute and/or chronic adversity that is seen as a major threat to a student's educational development.”<sup>8</sup> In other words, academic resilience describes a student's ability to improve academic performance after an adverse event such as failing an individual assessment (eg, test, objective structured clinical examination) or course.<sup>9</sup> Although not previously explored in Doctor of Pharmacy (PharmD) students, resilience has been shown to affect how other student populations cope in a university environment, with more resilient students being better able to manage academic pressures than their less

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**Corresponding Author:** Marie Chisholm-Burns, University of Tennessee Health Science Center College of Pharmacy, 881 Madison Ave., Ste. 264, Memphis, TN 38163. Tel: 901-448-7141. Fax: 901-448-7053. E-mail: Mchisho3@uthsc.edu

resilient peers.<sup>5</sup> For example, a study focusing on resilience and academic success in urban Latino high school students found a positive correlation between resilience and academic achievement.<sup>4</sup>

Resilience also has a place in health professions education. When taught resilience strategies as a way to manage stress and become better practitioners, physical therapy students demonstrated improvement in how they responded to challenges in the clinical learning environment.<sup>6</sup> Similarly, “resilience through peer collaboration” was a contributing factor in enhancing medical student engagement in clinical education.<sup>10</sup> Likewise, enhancing resilience to assist in preventing or addressing negative academic outcomes may also be beneficial for pharmacy students. However, per a search of the literature (PubMed and Google Scholar, years unlimited), no published studies of academic resilience in pharmacy students were identified, nor was a reliable and valid scale to measure academic resilience in pharmacy students found. Such a scale may be needed as part of any comprehensive assessment of academic resilience in this population. Therefore, the primary objective of this study was to develop a valid and reliable scale by conducting factor analysis, reliability testing, and validity testing of an academic resilience scale adapted for use with pharmacy students in the didactic portion of the curriculum, prior to advanced pharmacy practice experiences (APPEs). A secondary objective was to assess whether academic resilience differed by student demographics (age, gender, race, and ethnicity), pre-pharmacy science grade point average (GPA), and professional year.

## METHODS

In the summer of 2017, the investigators initiated development of a scale to measure the academic resilience of pharmacy students. The first step was to conduct a literature search (PubMed and Google Scholar, years unlimited) of existing resilience scales. Numerous scales were identified (25 examples are provided in Appendix 1), and these scales fit into three major categories: general/global measures of resilience (eg, the Connor-Davidson Resilience Scale [CD-RISC]<sup>11</sup>), measures focused on resilience in children/adolescents (eg, Resilience Scale for Adolescents<sup>12</sup>), and measures focused on resilience in special populations (eg, Trauma Resilience Scale<sup>13</sup>). Several of these scales also had shortened versions and/or had been translated for use in multiple languages. However, the scales identified in this initial search were considered either too general for the study’s focus on academic resilience or not appropriate to the population of interest, ie, pharmacy students. Therefore, we narrowed the search to identify existing academic resilience measures in student populations in educational settings.

Two direct measures of academic resilience were identified for possible adaptation: Martin and Marsh’s measure of academic resilience and Cassidy’s Academic Resilience Scale-30 (ARS-30).<sup>9,14</sup> A third direct measure, the Academic Resilience in Mathematics scale, was excluded because of its specialized focus on mathematics (additionally, several items were based on the Martin and Marsh measure).<sup>15</sup> We also excluded the Resilience & Youth Development Module of the California Healthy Kids Survey<sup>16,17</sup> (targeted to middle and high school students) and the Student Orientation to School Questionnaire (SOS-Q; a measure of student engagement targeted to students in grades 4-12).<sup>18,19</sup> Although these multidimensional measures included some academic resilience items, the items were either inappropriate for the study population of professional-level students (eg, “I plan to graduate high school”) or were similar to items already included in the Martin and Marsh measure and ARS-30. Likewise, a systematic review conducted by Tudor and Spray identified six additional scales used in academic resilience research that we excluded upon further review because they were not considered actual measures of academic resilience.<sup>20</sup> Thus, the ARS-30 and Martin and Marsh’s measure of academic resilience remained for consideration.

The first direct measure of academic resilience that we examined was Martin and Marsh’s 6-item measure of academic resilience, which was originally targeted to high school students.<sup>14</sup> Martin also published a variant of this scale, the Academic Risk and Resilience Scale (ARRS), in which high school students were asked to rate themselves on four items adapted from the original Martin and Marsh scale if they had experienced one or more academic risks in the past year (eg, repeated a grade, suspended or expelled from school).<sup>21</sup> Although appealing in their brevity, we did not consider the Martin and Marsh measure and the ARRS sufficient for assessment of students in a professional-level program. More specifically, these scales lacked items concerning self-motivation and goal- or future-orientation that investigators believed were relevant to resilience in professional-level and/or pharmacy students. Also, the risks presented in the ARRS are more typical of those encountered in a high school setting than in a professional-level college program.

In contrast to the other scales, the ARS-30 was designed to assess response to adversity in students in an undergraduate, nonprofessional educational setting rather than in high school students.<sup>9</sup> Also, the ARS-30 included items addressing self-motivation and goal- or future-orientation.<sup>9</sup> Some have suggested that “a true resilience scale would measure an individual’s reaction to an experimental stress paradigm.”<sup>22</sup> In the ARS-30,

students are presented with a vignette describing an adverse postsecondary educational situation (ie, failing an assignment) and asked to respond to 30 items as if they were the student in the vignette. Per Cassidy, the scale includes a mix of positively- and negatively-worded items that ascertain behavioral, cognitive and/or emotional responses to adversity; items were developed based on published literature concerning resilience, academic resilience, self-efficacy, and self-regulated learning.<sup>9,23,24</sup> For the reasons outlined, the investigators selected the ARS-30 for adaptation in the pharmacy student population.

The exploratory factor analysis of the original ARS-30 indicated three factors (or subscales): perseverance; reflecting and adaptive help-seeking; and negative affect and emotional response. Psychometric testing of the instrument was conducted among undergraduate students, and found high internal consistency reliability (Cronbach alpha of .90 for the total scale and .78-.83 for the three subscales) and strong evidence of construct validity (ie, significant, positive correlation with academic self-efficacy).<sup>9</sup>

In the current study, the ARS-30 was adapted (with permission) for use with PharmD students who were in the didactic portion of the curriculum. As previously stated, the ARS-30 was initially developed for testing undergraduate students who had didactic coursework but no clinical experiences. Additionally, pharmacy students are more likely to experience academic stressors (eg, test anxiety, time management challenges) in didactic courses than in the experiential portion of the curriculum.<sup>25</sup> The study investigators therefore revised the vignette to portray an adverse scenario that a pharmacy student in the didactic portion of the curriculum might experience. The 30 scale items were also revised to capture pharmacy students' responses to this vignette. In addition to the changes made to the vignette and scale items, we had several concerns about the ARS-30: retention of items in the original scale with low factor loadings; inclusion of redundant items, eg, "I would keep trying" and its reverse-scored opposite "I would just give up"; unnecessary repetition that could be eliminated and result in a briefer, more efficient measure; compounded statements which could present challenges in interpretation, eg, "I would start to monitor and evaluate my achievements and effort"; and items focused on internal rather than external locus of control, which might be more relevant to the academic resilience of professional-level pharmacy students. Because of these concerns, the study investigators believed it would be more appropriate to conduct an exploratory factor analysis of the adapted ARS-30 (see the statistical analysis section below), rather than a confirmatory factor analysis.

A five-point Likert scale ranging from 1=unlikely to 5=likely was used to assess level of response to each item (Appendix 2). Scores of 10 negatively worded items were reversed so that higher scores indicated a more adaptive or resilient response, which was consistent with the direction of scoring for the remaining 20 items. To reverse the scores of 10 negatively worded items, a response of 5 was scored as 1 (and vice versa); a response of 4 was scored as 2 (and vice versa); and 3 remained unchanged as the neutral value. The content validity of the items was reviewed and affirmed.

Convergent validity is a type of construct validity in which a measure is highly correlated with another measure of a similar or related concept.<sup>26</sup> Grit is a noncognitive concept defined as the ability to pursue challenging goals with perseverance and passion. Resilience is a noncognitive concept defined as the ability to overcome or adapt to adverse or challenging circumstances. Grit was used to assess convergent validity since grit and resilience share the key aspect of persevering through adverse circumstances. Previous investigators noted the commonality between the two concepts.<sup>27-29</sup> Thus, convergent validity testing of the adapted academic resilience scale was conducted using the eight-item Short Grit Scale (Grit-S, Appendix 3), developed by Duckworth and Quinn.<sup>27</sup> A prior study provides evidence of the consensual and predictive validity of the Grit-S.<sup>27</sup> Confirmatory factor analysis of the Grit-S was previously conducted with pharmacy students with good model fit, suggesting evidence of construct validity.<sup>30</sup> The Cronbach alpha of the Grit-S was previously reported as ranging from .73 to .83, depending on the study population (eg, West Point cadets, participants in the National Spelling Bee, undergraduate students, and pharmacy students).<sup>27,30</sup> The Grit-S has two subscales: Perseverance of Effort and Consistency of Interest. In prior research, the Cronbach alpha of the Perseverance of Effort subscale ranged from .60 to .78, and the Cronbach alpha of the Consistency of Interest subscale ranged from .73 to .79.<sup>27</sup>

For each item of the Grit-S, a five-point Likert scale was used to assess level of response. Scores of four positively worded items range from 1=not like me at all to 5=very much like me. Scores of the remaining four negatively worded items were reversed so that higher scores indicated greater grit. To reverse the scores of these items, a response of 5 was scored as 1 (and vice versa); a response of 4 was scored as 2 (and vice versa); and 3 remained unchanged as the neutral value (ie, somewhat like me). Total scale score was calculated by summing the eight items and dividing by eight. Total scores ranged from 1 to 5, with 5 being the highest possible score. Subscale scores were likewise calculated by summing the

applicable four items and dividing by four. Subscale scores ranged from 1 to 5, with 5 being the highest possible score.

All first-year (P1), second-year (P2), and third-year (P3) pharmacy students ( $n=544$ ) at the University of Tennessee College of Pharmacy were invited to participate in the study in August 2017. Survey instruments were distributed to and collected from students in a classroom setting at the beginning of the fall semester. A study coordinator was responsible for survey administration. The survey took 10 to 15 minutes to complete. Participation in the study was voluntary, no incentives were offered to students, and investigators were blinded to the identity of participants.

The survey included the newly adapted academic resilience scale and the Grit-S (Appendices 2 and 3). To provide a demographic description of the student sample, the following data were collected from official student records by the study coordinator: age, gender, ethnicity, race, and pre-pharmacy science GPA. Student data were housed in a study database and matched to individual student survey data by the study coordinator. The coordinator then de-identified the database and transferred it to the investigators; thus, the investigators remained blinded to the identities of the students. The study was approved by the University of Tennessee Health Science Center Institutional Review Board.

Data analysis was performed using SPSS Statistics 25.0 (IBM, Armonk, NY). Student characteristics data were summarized as descriptive statistics (frequencies for categorical variables, means and standard deviations for continuous variables), as were the total and subscale scores of the adapted academic resilience scale and Grit-S. Participants and nonparticipants were compared using chi square and independent samples  $t$  tests ( $\alpha$  priori significance level was .05). Missing scale data were addressed using the individual mean imputation method, wherein the "imputed value is the calculated mean of a given subject's complete responses to other questions."<sup>31</sup> Exploratory factor analysis was conducted for the adapted academic resilience scale to examine scale dimensionality (ie, the number of separate constructs assessed by scale items) and determine the number of underlying factors responsible for covariation of the data.<sup>32,33</sup> Principal components analysis was used as the extraction method. Varimax was used as the rotation method because it minimizes the number of items with high loadings on each factor.<sup>33</sup> A scree plot was used to determine the number of meaningful factors. Items were considered to have loaded on a factor if the factor loading was greater than .5 on that particular factor and less than .4 on any other factor.<sup>32</sup> Items that did not load on any factors were excluded from

the final scale, as were factors on which less than three items loaded.<sup>34</sup> Confirmatory factor analysis was conducted to assess the construct validity of the Grit-S subscales. Based on Cangur and Ercan, acceptable model fit indices were comparative fit index (CFI)  $>.95$ , standardized root mean square residual (SRMR)  $<.05$ , and root mean squared error of approximation (RMSEA)  $<.05$  (.05-.08 was considered "close to good").<sup>35</sup> The Cronbach alpha coefficient of internal consistency was used to estimate scale reliability, ie, the extent to which scale scores are stable and consistent.<sup>36-38</sup> When developing a new scale, a Cronbach alpha of .7 or above is preferred, while .65 is considered minimally acceptable.<sup>39,40</sup>

Because of the non-normality of the data, the Mann-Whitney U test or Kruskal-Wallis test (post hoc pairwise comparisons were conducted) was used to assess differences in academic resilience score and Grit-S score based on gender, ethnicity, race, and year of pharmacy school (P1, P2, and P3). Pearson's  $r$  correlations were used to assess the strength of relationships between age, pre-pharmacy science GPA, academic resilience score, and Grit-S score. The Bonferroni adjustment was applied, making the alpha level  $p<.002$  for the Mann-Whitney U tests. The a priori significance level was .05 for all other analyses conducted.

## RESULTS

Of 544 first-, second-, and third-year pharmacy students invited to participate, 457 (84%) completed the survey. Table 1 presents student demographic characteristics, as well as a comparison of participants and nonparticipants (please note, of 457 participants, 12 surveys could not be linked to student records due to lack of identifier; data for the remaining 445 students who completed the survey instrument were linked to student records data). The majority of participants were female (62.9%), non-Hispanic (96.6%), and white (69.7%). Mean age of participants was 24.3 years ( $SD=3.3$ ) and mean pre-pharmacy science GPA was 3.19 ( $SD=.47$ ). There were no significant differences between participants and nonparticipants in terms of demographic characteristics with two exceptions. Nonparticipants were significantly older than participants ( $M=25.6$  years,  $SD=4.5$  vs.  $M=24.3$  years,  $SD=3.3$ , respectively;  $p=.006$ ). Additionally, the nonparticipant group was composed of a higher percentage of P3 students and a lower percentage of P1 students ( $\chi^2=32.3$ ,  $p<.001$ ).

In the exploratory factor analysis of the adapted academic resilience scale, four factors or subscales were identified. The scree plot also suggested four meaningful factors. Fourteen items were deleted from the scale because they failed to load on any of the four factors



Table 1. Characteristics of Participants<sup>a</sup> and Nonparticipants in a Study to Develop an Instrument for Measuring Academic Resilience in Pharmacy Students (N=544)

	All P1-P3 Students, No. (%)	Participants No. (%)	Nonparticipants No. (%)	<i>p</i> Value
Mean Age (SD)	24.6 (3.5)	24.3 (3.3)	25.6 (4.5)	.006
Mean Pre-pharmacy Science GPA (SD) <sup>b</sup>	3.19 (.47)	3.19 (.46)	3.19 (.48)	.91
Class				<.001
P1	182 (33.5)	170 (38.2)	12 (12.1)	
P2	171 (31.4)	140 (31.5)	31 (31.3)	
P3	191 (35.1)	135 (30.3)	56 (56.6)	
Gender				.24
Female	336 (61.8)	280 (62.9)	56 (56.6)	
Male	208 (38.2)	165 (37.1)	43 (43.4)	
Ethnicity				.74
Hispanic	19 (3.5)	15 (3.4)	4 (4)	
Non-Hispanic	525 (96.5)	430 (96.6)	95 (96)	
Race				.81
Minority	150 (27.6)	124 (27.9)	26 (26.3)	
White	379 (69.7)	310 (69.7)	69 (69.7)	
Missing	15 (2.8)	11 (2.5)	4 (4)	

Abbreviations: P1=first-year pharmacy student, P2=second-year pharmacy student, P3=third-year pharmacy student

<sup>a</sup> Note: a total of 457 completed surveys were submitted and used in the factor analysis of the adapted academic resilience scale. However, 12 surveys could not be linked to student records due to lack of identifier. Data for the remaining 445 students who completed the survey instrument were linked to student records data

<sup>b</sup> Data were normally distributed

(additional reasons for deletion, based on reviews by two study investigators, are addressed in Table 2). The remaining 16 items were included in the final version of the scale, the Academic Pharmacy Resilience Scale (APRS-16). Refer to Table 3 for frequency of student responses and final factor loadings for each of the 16 items. Refer to Table 4 for mean and median scores of the 16 items. Possible total scores of the 16-item scale range from 16 to 80, with higher scores indicating greater academic resilience (see Table 5 for mean and median total scale and subscale scores). The Cronbach alpha coefficient of the APRS-16 was .84.

The four factors, or subscales, were labeled “negative affect and emotional response,” “reflecting and adaptive help-seeking,” “adaptive thought processes,” and “perseverance.” “Negative affect and emotional response” and “reflecting and adaptive help-seeking” each included five items, with scores ranging from 5 to 25. “Adaptive thought processes” and “perseverance” each included three items, with scores ranging from 3 to 15. See Table 5 for the Cronbach alpha coefficients of the four factors/subscales. The variance for the “negative affect and emotional response” subscale was 13.4%, “reflecting and adaptive help-seeking” subscale was 13.2%, “adaptive thought processes” subscale was 9.3%, and “perseverance” subscale was 8.9%; total variance was 44.8%. Item to total correlations ranged from .26 to .64.

The Cronbach alpha coefficient of the Grit-S in this study was .74. See Table 5 for Cronbach alpha coefficients of the two Grit-S subscales. The construct validity of the Grit-S was confirmed in the confirmatory factor analysis, as both subscales had significant factor loadings ( $p<.001$ ) from the subscale items. Additionally, the model fit indices were acceptable in the case of the CFI and SRMR (CFI=.957, SRMR=.048) and close to acceptable in the case of the RMSEA (.064). The students’ mean and median total scale and subscale scores on the Grit-S are also presented in Table 5. In the convergent validity analysis, the APRS-16 and its subscales were significantly, positively correlated with the Grit-S and its subscales ( $p<.001$ ; Table 6).

There were no differences in scores on the APRS-16, Grit-S, or their subscales based on ethnicity and race. Male students scored higher compared to female students on the “negative affect and emotional response” subscale of the APRS-16 (Median=15, Interquartile Range [IQR]=8 vs. Median=12, IQR=6, respectively;  $p<.001$ ), while female students scored higher compared to male students on the “reflecting and adaptive help-seeking” subscale (Median=23, IQR=5 vs Median=21, IQR=4, respectively;  $p=.001$ ). No other significant differences were found based on gender. As displayed in Table 7, in the comparison of years of pharmacy school, first-year students generally had significantly higher

Table 2. Items Deleted from the Academic Pharmacy Resilience Scale (APRS-16) and Reason(s) for Deletion Following Exploratory Factor Analysis<sup>a</sup>

	Reason(s) for Item Deletion <sup>a</sup>
1. I would not accept the instructors' feedback. <sup>b</sup>	All items concerning instructors (ie, externally-focused items) failed to load on any of the four factors in the factor analysis, suggesting internally-focused items may be more relevant to measure academic resilience in pharmacy students who are generally more mature/independent than undergraduate students. Additionally, the inclusion of this particular item in the original Academic Resilience Scale-30 was somewhat questionable given its low factor loading (.146 on the Perseverance factor).
2. I would use the feedback to improve my exam performance.	See Item 1 reason for item deletion.
3. I would use the situation to motivate myself.	Item 7 (see Table 3) in the final APRS-16 also addressed self-motivation, raising concerns of unnecessary redundancy.
4. I would probably get annoyed. <sup>b</sup>	This item is most closely aligned with the "Negative Affect and Emotional Response" subscale; however, the emotion expressed in this item (annoyance or irritation) differs considerably from the emotions expressed in the "Negative Affect and Emotional Response" items included in the final version of the APRS-16: doubt, depression, disappointment, feeling as though everything was ruined. Therefore, this item was excluded due to lack of subscale fit.
5. I would work harder.	Three variations of this theme were included in the adapted 30-item scale: "I would work harder," "I would keep trying," and "I would just give up." The reverse-scored item ("I would just give up") was included in the final version of the APRS-16. This item was excluded to eliminate unnecessary redundancy.
6. I would blame the instructor(s). <sup>b</sup>	See Item 1 reason for item deletion.
7. I would keep trying.	See Item 5 reason for item deletion.
8. I would start to monitor and evaluate my achievements and effort.	Item excluded due to inclusion of multiple concepts (monitor, evaluate, achievements, effect) – unclear what item is measuring.
9. I would seek help from my instructors.	See Item 1 reason for item deletion.
10. I would give myself encouragement.	Item was excluded to eliminate unnecessary redundancy, as this item is thematically similar to other items (eg, Item 7 in Table 3) included in the final version of the APRS-16.
11. I would stop myself from panicking.	This item is most closely aligned with the "Negative Affect and Emotional Response" subscale; however, the active response expressed in this item ("would stop myself") differs from the more passive response of other "Negative Affect and Emotional Response" subscale items ("begin to doubt," "begin to think," "get depressed," "be very disappointed," "feel like everything was ruined"). Therefore, this item was excluded due to lack of subscale fit.
12. I would try different ways to study.	Item is thematically similar to Item 6 (see Table 3) in the final version of the ASPR-16, raising concerns of unnecessary redundancy.
13. I would start to self-impose rewards and punishments depending on my performance.	Item excluded due to concerns about compound concepts (rewards and punishments).
14. I would look forward to showing that I can improve my grades.	Item is thematically similar to Item 8 (see Table 3) in the final version of the ASPR-16, raising concerns of unnecessary redundancy.

<sup>a</sup> The reason(s) provided are in addition to each item's failure to load on any of the four factors identified in the factor analysis, per the following criteria: factor loading greater than .5 on a particular factor and less than .4 on any other factor.<sup>32</sup>

<sup>b</sup> Indicates reverse-scored items

Table 3. Frequency of Pharmacy Student Responses to Items Included in the Final Version of the Academic Pharmacy Resilience Scale (APRS-16) Following Exploratory Factor Analysis and Final Factor Loadings for Each Item

	Likely	Somewhat Likely	Neutral	Somewhat Unlikely	Unlikely	Factor 1- Negative Affect and Emotional Response <sup>b</sup>	Factor 2 - Reflecting and Adaptive Help- Seeking <sup>b</sup>	Factor 3 – Adaptive Thought Processes <sup>b</sup>	Factor 4 - Perseverance <sup>b</sup>
1. I would begin to doubt my chances of success in the PharmD program. <sup>a</sup>	63	166	70	88	70	<b>.74</b>	-.03	.10	.21
2. I would probably get depressed. <sup>a</sup>	80	152	71	84	70	<b>.78</b>	.05	.19	.14
3. I would be very disappointed. <sup>a</sup>	266	129	28	20	14	<b>.67</b>	.10	-.21	-.09
4. I would begin to think my chances of getting the job or residency I want were poor. <sup>a</sup>	63	184	96	83	31	<b>.69</b>	.11	.03	.17
5. I would feel like everything was ruined and going wrong. <sup>a</sup>	67	90	93	132	75	<b>.73</b>	.05	.30	.18
6. I would try to think of new solutions.	248	170	29	9	1	-.02	<b>.58</b>	.22	.24
7. I would use my past successes to help motivate myself.	260	140	36	17	4	.17	<b>.51</b>	.32	.39
8. I would set my own goals for achievements.	233	176	39	7	2	.16	<b>.61</b>	.31	.07
9. I would seek encouragement from my family and friends.	252	117	34	30	24	.08	<b>.71</b>	-.15	.02
10. I would try to think about my strengths and weaknesses to help me work better.	222	169	42	19	5	.16	<b>.69</b>	.29	.04
11. I would see the situation as a challenge.	185	181	64	24	3	-.03	.21	<b>.60</b>	.20

(Continued)

Table 3. (Continued)

						Factor 1- Negative Affect and Emotional Response <sup>b</sup>	Factor 2 - Reflecting and Adaptive Help- Seeking <sup>b</sup>	Factor 3 – Adaptive Thought Processes <sup>b</sup>	Factor 4 - Perseverance <sup>b</sup>
	Likely	Somewhat Likely	Neutral	Somewhat Unlikely	Unlikely				
12. I would do my best to stop thinking negative thoughts.	150	164	81	46	16	.37	.33	<b>.58</b>	.03
13. I would see the situation as temporary.	143	194	78	38	4	.36	.09	<b>.64</b>	.16
14. I would just give up. <sup>a</sup>	5	13	32	83	324	.19	.01	.09	<b>.62</b>
15. I would change my career plans. <sup>a</sup>	9	19	68	128	233	.18	.07	.04	<b>.73</b>
16. I would not change my long-term goals and ambitions.	231	142	49	24	11	.11	.17	.10	<b>.65</b>

<sup>a</sup> Indicates reverse-scored items. Frequencies provided in Table 1 represent original responses, prior to reverse-scoring

<sup>b</sup> Bolded factor loading values indicate the items that loaded on a given factor and are included in that particular subscale

scores on the APRS-16, Grit-S, and their respective subscales (with few exceptions) when compared to second- and third-year students. No significant correlations were found between the APRS-16, its subscales, and student age. Likewise, no significant correlations were found between the Grit-S, its subscales, and student age. No significant correlations were found between either scale, their respective subscales, and pre-pharmacy science GPA.

## DISCUSSION

Because of increasing interest in assessment of non-cognitive factors as part of the pharmacy school admissions process, pharmacy educational programming (eg, co-curricular), and academic advising, reliable and valid instruments are needed to measure these factors. As a valid and reliable academic resilience scale targeted to pharmacy students was not available in the published literature, the primary purpose of the current study was to conduct factor analysis, reliability testing, and validity testing of an academic resilience scale adapted for use with pharmacy students in the didactic portion of the curriculum. Following a review of available resilience scales, study investigators selected and adapted Cassidy's ARS-30 for use in the pharmacy student population.<sup>9</sup> The

instrument vignette was rewritten and item wording was modified to better reflect the experiences of pharmacy students. The 30-item adapted scale underwent factor analysis, and the final scale included 16 items and 4 subscales. The Cronbach alpha of the total scale was .84, which suggests strong internal consistency (reliability).<sup>39,40</sup> Grit was identified as a concept similar to academic resilience, and therefore the Grit-S was selected for inclusion in the convergent validity analysis.<sup>28</sup> Significant, medium to large, positive correlations were noted between the APRS-16, the Grit-S, and their respective subscales, providing evidence of the convergent validity of the measures.<sup>41</sup> Therefore, the APRS-16 is considered a reliable and valid measure.

The naming of the four subscales of the APRS-16 was based on the subscales of the original ARS-30. The original ARS-30<sup>9</sup> had three subscales: "perseverance," "reflecting and adaptive help-seeking," and "negative affect and emotional response," while the APRS-16 has four subscales: "perseverance," "reflecting and adaptive help-seeking," "negative affect and emotional response," and "adaptive thought processes." In comparing the subscales of the adapted and original scales, each item of the adapted scale aligned with its original subscale with two exceptions. First, the three items that compose the adaptive



Table 4. Mean Pharmacy Student Scores<sup>a</sup> (Standard Deviation) and Median Pharmacy Student Scores<sup>a</sup> on the Academic Pharmacy Resilience Scale (APRS-16) Items

	Mean (SD)	Median
1. I would begin to doubt my chances of success in the PharmD program. <sup>b</sup>	2.9 (1.3)	2
2. I would probably get depressed. <sup>b</sup>	2.8 (1.3)	2
3. I would be very disappointed. <sup>b</sup>	1.7 (.99)	1
4. I would begin to think my chances of getting the job or residency I want were poor. <sup>b</sup>	2.6 (1.1)	2
5. I would feel like everything was ruined and going wrong. <sup>b</sup>	3.1 (1.3)	3
6. I would try to think of new solutions.	4.4 (.72)	5
7. I would use my past successes to help motivate myself.	4.4 (.85)	5
8. I would set my own goals for achievements.	4.4 (.74)	5
9. I would seek encouragement from my family and friends.	4.2 (1.2)	5
10. I would try to think about my strengths and weaknesses to help me work better.	4.3 (.88)	4
11. I would see the situation as a challenge.	4.1 (.89)	4
12. I would do my best to stop thinking negative thoughts.	3.8 (1.1)	4
13. I would see the situation as temporary.	4 (.95)	4
14. I would just give up. <sup>b</sup>	4.6 (.83)	5
15. I would change my career plans. <sup>b</sup>	4.2 (.98)	5
16. I would not change my long-term goals and ambitions.	4.2 (1)	5

<sup>a</sup> Item scores range from 1 to 5, with higher score indicating greater resilience

<sup>b</sup> Indicates reverse-scored items

thought processes subscale of the APRS-16 originally loaded on the “perseverance” subscale of the ARS-30. However, we believe the wording of the items (eg, “I would see the situation as a challenge”) is more suggestive of adaptive thinking than perseverance. Second, one item (“I would try to think of new solutions”) that previously loaded on the “perseverance” subscale of the ARS-30 was included in the “reflecting and adaptive help-seeking” subscale of the APRS-16. Again, the wording of the item would support its closer alignment with concepts of reflection and adaptation than with perseverance.

With an average score of approximately 60 (range=34-80, with 80 being the highest possible score) on the overall

APRS-16, P1-P3 students’ responses generally indicated they had moderately high academic resilience. Moderately high average scores were also noted on three of the four APRS-16 subscales: “reflecting and adaptive help-seeking,” “adaptive thought processes,” and “perseverance.” However, the average score on the “negative affect and emotional response” subscale, a score of 13.1 (range=5 to 25, with 25 being the highest possible score) suggested that students may have struggled more with negative reactions to academic difficulties, such as depression or disappointment. Consistent with the APRS-16, average scores on the Grit-S and its subscales indicated a moderate to high level of grit among the students.

Table 5. Mean Pharmacy Student Scores<sup>a</sup> (Standard Deviation), Median Pharmacy Student Scores,<sup>a</sup> Score Ranges, and Cronbach’s Alpha of the Academic Pharmacy Resilience Scale (APRS-16), Short Grit Scale (Grit-S) and Respective Subscales

	Mean (SD)	Median	Score Range	Cronbach’s Alpha
APRS-16	59.7 (8.9)	60	34-80	.84
Factor 1: Negative Affect and Emotional Response	13.1 (4.7)	13	5-25	.82
Factor 2: Reflecting and Adaptive Help-Seeking	21.7 (3.1)	22	9-25	.75
Factor 3: Adaptive Thought Processes	12 (2.3)	12	5-15	.65
Factor 4: Perseverance	13 (2.1)	14	5-15	.61
Grit-S	3.7 (.55)	3.6	1.9-5	.74
Consistency of Interest (Grit-S Subscale)	3.3 (.75)	3.3	1-5	.75
Perseverance of Effort (Grit-S Subscale)	4 (.58)	4	1.5-5	.61

<sup>a</sup> Possible total scores of the APRS-16 range from 16 to 80. Possible scores on the “Negative Affect and Emotional Response” subscale and “Reflecting and Adaptive Help-Seeking” subscale ranged from 5 to 25. Possible scores on the “Adaptive Thought Processes” subscale and “Perseverance” subscale ranged from 3 to 15. Higher scores on the APRS-16 and its subscales indicate greater academic resilience. For the Grit-S, possible total and subscale scores ranged from 1 to 5, with higher scores indicating greater grit

Table 6. Correlations Among the Academic Pharmacy Resilience Scale (APRS-16), Short Grit Scale (Grit-S), and Respective Subscales

	Grit-S	Consistency of Interest (Grit-S Subscale)	Perseverance of Effort (Grit-S subscale)
APRS-16			
Pearson's <i>r</i>	.46	.33	.45
<i>p</i> value	<.001	<.001	<.001
APRS-16 Factor 1: Negative Affect and Emotional Response			
Pearson's <i>r</i>	.37	.28	.33
<i>p</i> value	<.001	<.001	<.001
APRS-16 Factor 2: Reflecting and Adaptive Help-Seeking			
Pearson's <i>r</i>	.31	.20	.33
<i>P</i> value	<.001	<.001	<.001
APRS-16 Factor 3: Adaptive Thought Processes			
Pearson's <i>r</i>	.36	.20	.42
<i>P</i> value	<.001	<.001	<.001
APRS-16 Factor 4: Perseverance			
Pearson's <i>r</i>	.30	.25	.24
<i>P</i> value	<.001	<.001	<.001

With scale development completed, a preliminary analysis of available demographic and pre-pharmacy data to assess possible differences between APRS-16 and Grit-S scores (overall and subscale scores) based on students' age, gender, race, ethnicity, year in pharmacy school, and pre-pharmacy science GPA was conducted. No differences or associations were noted based on age, race, ethnicity, or pre-pharmacy science GPA. The latter was unsurprising as the authors had postulated that an indicator of academic performance prior to pharmacy school, ie, the pre-pharmacy science GPA, was not likely to correlate with an instrument specifically designed to measure resilience while in pharmacy school. However, our comparison of the two scales did find that male students had significantly higher scores on the "negative affect and emotional response" subscale compared to female students, which meant that male students, in general, had less negative affect and emotional response than female students. Conversely, female students had significantly higher scores on the "reflecting and adaptive help-seeking" subscale, which meant that female students, in general, were more reflective and adaptive than male students. The reasons for these gender distinctions are not clear. Future studies should consider gender differences when assessing students' academic resilience and the possible impact these differences may have on performance. Additionally, P1s were generally found to have significantly higher academic resilience and grit scores than P2s and P3s. As with the gender findings, the reasons for the differences between years of pharmacy school are not clear. Future longitudinal studies should be conducted to better understand changes in academic resilience as students progress through pharmacy school.

Noncognitive factors such as academic resilience and grit may serve as critical indicators of student performance during professional education programming.<sup>42-45</sup> For example, Hojat and colleagues found that select noncognitive characteristics had greater predictive value than Medical College Admissions Test (MCAT) scores in terms of assessing students' clinical competence during clerkships.<sup>42</sup> Among other factors, medical students were more likely to have better clinical competence if they had less external locus of control (eg, less likely to attribute control to external factors and more likely to believe in their own influence over events) and greater sociability (eg, more extroverted and thus able to engage with support resources).<sup>42</sup> Likewise, studies of dental student performance also found that noncognitive traits, such as self-efficacy, locus of control, and aspects of conscientiousness (eg, competence, achievement-striving, self-discipline), were significantly predictive of academic and clinical performance.<sup>44,45</sup> Similarly, Beauvais and colleagues reported that resilience was associated with greater academic success among graduate nursing students.<sup>7</sup> Noncognitive factors may also be useful in determining how well students cope with the stress and demands of professional programs. In a study of medical students across five institutions, Dyrbye and colleagues noted that those who were more resilient experienced less depression, had a better quality of life and less stress and fatigue, and perceived their learning environment more positively than their less resilient peers.<sup>46</sup> In a survey of students in an undergraduate social work program, McClafferty and colleagues found that resilience was the strongest significant predictor of successful coping

Table 7. Comparison of Pharmacy Students' Scores on the Academic Pharmacy Resilience Scale (APRS-16), Short Grit Scale (Grit-S), and Respective Subscales Based on Year of Pharmacy School

	Mean (SD)	Median (IQR)	Comparison	p value
APRS-16				
P1	62.3 (8.5)	62 (11)	P1 vs. P2	<.001
P2	58.7 (8.2)	58.5 (11)	P1 vs. P3	<.001
P3	57.5 (9.3)	58 (13)	P2 vs. P3	NS
APRS-16 Factor 1: Negative Affect and Emotional Response				
P1	14 (4.7)	14 (6)	P1 vs. P2	NS
P2	12.7 (4.5)	12 (7)	P1 vs. P3	.009
P3	12.4 (4.6)	12 (7)	P2 vs. P3	NS
APRS-16 Factor 2: Reflecting and Adaptive Help-Seeking				
P1	22.5 (2.9)	23 (4)	P1 vs. P2	<.001
P2	21.4 (2.8)	22 (4)	P1 vs. P3	<.001
P3	20.9 (3.5)	21 (5)	P2 vs. P3	NS
APRS-16 Factor 3: Adaptive Thought Processes				
P1	12.5 (2.1)	13 (3)	P1 vs. P2	<.001
P2	11.6 (2.2)	12 (3)	P1 vs. P3	<.001
P3	11.6 (2.3)	12 (3)	P2 vs. P3	NS
APRS-16 Factor 4: Perseverance				
P1	13.3 (1.9)	14 (3)	P1 vs. P2	NS
P2	13 (1.9)	13 (3)	P1 vs. P3	NS
P3	12.6 (2.5)	14 (4)	P2 vs. P3	NS
Grit-S				
P1	3.8 (.51)	3.9 (.66)	P1 vs. P2	.006
P2	3.6 (.54)	3.6 (.75)	P1 vs. P3	.001
P3	3.6 (.59)	3.6 (.88)	P2 vs. P3	NS
Consistency of Interest (Grit-S subscale)				
P1	3.5 (.72)	3.5 (1)	P1 vs. P2	.017
P2	3.2 (.71)	3.3 (1)	P1 vs. P3	.004
P3	3.2 (.8)	3.3 (1)	P2 vs. P3	NS
Perseverance of Effort (Grit-S subscale)				
P1	4.1 (.51)	4.3 (.75)	P1 vs. P2	NS
P2	4 (.68)	4 (.94)	P1 vs. P3	.039
P3	3.9 (.64)	4 (1)	P2 vs. P3	NS

IQR, interquartile range; NS, not significant; P1, first-year pharmacy student; P2, second-year pharmacy student; P3, third-year pharmacy student

among several variables examined, including age and emotional intelligence.<sup>5</sup> The authors suggested that resilience and coping skills may ultimately determine students' academic outcomes, as well as their ability to address stressors in their future careers.

As resilience and its effects on pharmacy student performance have not been explored in the academic pharmacy literature, future studies should use the APRS-16 to examine the association between academic resilience and outcomes among pharmacy students. Such outcomes include course and overall grade point average, performance on high stakes examinations including the North American Pharmacist Licensure Examination, and the attainment of practice readiness. Once a better understanding of the relationship between academic resilience and pharmacy student outcomes has been cultivated, stud-

ies should then be conducted to develop and evaluate interventions designed to improve resilience among pharmacy students and, in turn, promote success. Future studies may also want to examine the interplay of resilience, grit, and other noncognitive factors, such as emotional maturity, which is defined as "the ability of facilitating and guiding emotional tendencies to reach intended goals."<sup>47</sup> Exploration of additional noncognitive factors, and the dynamics between said factors may help to provide a more complete understanding of student success.

This study is not without limitations. One possible limitation is that the total variance explained in the factor analysis was approximately 45%. Although one source recommends a "rule of thumb" of 70% or greater total variance, others suggest focusing on achieving a

minimum number of factors and items to explain a maximum percentage of the variance, and this efficiency is demonstrated in the APRS-16.<sup>33,48,49</sup> Given that the total variance of our 16-item scale (~45%) is slightly higher than the total variance (~42%<sup>9</sup>) of the original ARS-30, this would suggest the percentage of total variance explained is acceptable. Further supporting this assertion, the number of factors found in this study's factor analysis generally aligned with the number found in the original version of the scale. Another limitation is that the study sample was restricted to students at one college of pharmacy, which may affect the generalizability to other pharmacy student cohorts. However, the sample was generally reflective of the broader US pharmacy student population, which is 62% female (compared to 62.9% of our sample), 5.7% Hispanic (compared to 3.4% of our sample), and 36% minority (compared to 27.9% of our sample). Although significant differences were noted between participants and nonparticipants based on year of pharmacy school, roughly one-third of participants (30.3% to 38.2%) were from each of P1-P3 cohorts. We therefore believe the somewhat greater representation of the P3 class in the nonparticipant group compared to P1s had only marginal effects.

## CONCLUSION

Resilience is an important determinant of academic success, but has not been previously explored among pharmacy students in the published literature. Therefore, development of a valid and reliable scale to measure academic resilience in pharmacy students was necessary as a first step to develop a better understanding of this critical noncognitive factor. As adapted and evaluated in this study, the Academic Pharmacy Resilience Scale (APRS-16), measures four facets of academic resilience: "negative affect and emotional response," "reflecting and adaptive help-seeking," "adaptive thought processes," and "perseverance," and evidence supports its reliability and validity as a measure in pharmacy students. Future studies should investigate the relationship between academic resilience and outcomes among pharmacy students, as well as the impact of interventions to promote resilience and success in this population.

## ACKNOWLEDGMENTS

The authors would like to thank Andria White for her assistance in data collection on this project. Conflicts of interest: Marie Chisholm-Burns serves on the board of directors of the Accreditation Council for Pharmacy Education (ACPE). This article does not represent ACPE's or the board of directors' opinions or views.

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**Appendix 1. Examples of Resilience Scales**

Scale	Reason Scale was Not Selected for Study	Key Reference(s) <sup>a</sup>
Acculturation and Resilience Scale	Not applicable to study population; targeted to culturally and linguistically diverse populations such as migrants, refugees, and international students.	Khawaja NG, Moisuc O, Ramirez E. Developing an Acculturation and Resilience Scale for use with culturally and linguistically diverse populations. <i>Australian Psychologist</i> . 2014;49:171-180.
Adolescent Resilience Scale	General measure of resilience rather than focused on academic resilience. Targeted to adolescents; not applicable to study population of professional-level students.	Oshio A, Nakaya M, Kaneko H, Nagamine S. Development and validation of an Adolescent Resilience Scale. <i>Japanese J Couns Sci</i> . 2002;35:57-65.
Brief Resilience Scale	General measure of resilience rather than focused on academic resilience.	Smith BW, Dalen J, Wiggis K, Tooley E, Christopher P, Bernard J. The brief resilience scale: assessing the ability to bounce back. <i>Int J Beh Med</i> . 2008;15:194-200.
Brief Resilient Coping Scale	Focused on resilient coping in reaction to stress, rather than academic resilience.	Sinclair VG, Wallston KA. The development and psychometric evaluation of the Brief Resilient Coping Scale. <i>Assessment</i> . 2004;11(1):91-101.
Child and Youth Resilience Measure	Culturally sensitive measure of youth resilience.	Ungar M, Liebenberg L. Assessing resilience across cultures using mixed methods: construction of the Child and Youth Resilience Measure. <i>J Mix Methods Res</i> . 2011;5:126-149.
Connor-Davidson Resilience Scale	General measure of resilience rather than focused on academic resilience.	Connor KM, Davidson JRT. Development of a new resilience scale: the Connor-Davidson Resilience Scale (CD-RISC). <i>Depress Anxiety</i> . 2003;18:76-82.
Dispositional Resilience Scale	Measure of resilience qualities related to psychological hardiness rather than focused on academic resilience.	Bartone P. Development and validation of a short hardiness measure. Paper presented at the annual convention of the American Psychological Society. Washington DC; 1991. Bartone PT. A short hardiness scale. Paper presented at the annual convention of the American Psychological Society. New York 1995. Bartone PT. Test-retest reliability of the Dispositional Resilience Scale-15, a brief hardiness scale. <i>Psychol Rep</i> . 2007;101(3):943-944.
Ego-resiliency Scale	General measure of resilience rather than focused on academic resilience.	Block J, Kremen AM. IQ and ego-resiliency: Conceptual and empirical connections and separateness. <i>J Pers Soc Psychol</i> . 1996;70:349-361.
Family Resilience Assessment Scale	Not applicable to study population; for use in assessing resilience in families.	Tucker Sixbey M. <i>Development of the Family Resilience Assessment Scale to Identify Family Resilience Constructs</i> [dissertation]. Gainesville, Florida. University of Florida, 2005. <a href="http://etd.fcla.edu/UF/UFE0012882/sixbey_m.pdf">http://etd.fcla.edu/UF/UFE0012882/sixbey_m.pdf</a> . Accessed July 24, 2019.
Health-related Resiliency Scale	Not applicable to study population; for use in patients living with chronic medical conditions.	Jimenez-Torres GJ, Wojna V, Rosario E, Hechevarría R, Alemán-Batista AM, Ríos Matos M, Madan A, Skolasky R, Acevedo SF. Assessing health-related resiliency in HIV+ Latin women: preliminary psychometric findings. <i>PLoS One</i> . 2017;12(7):e0181253.

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Appendix 1. (Continued)

Scale	Reason Scale was Not Selected for Study	Key Reference(s) <sup>a</sup>
Mexican Scale of Resilience Measurement	Not applicable to study population; for use in the Mexican population.	Palomar LJ, Gómez VNE. Desarrollo de una escala de medición de la resiliencia con mexicanos (RESI-M) [Construction of a measurement scale of resilience in Mexicans (RESI-M)] <i>Interdisciplinaria</i> . 2010;27:7-22. Toledano-Toledano F, del la Rubia JM, McCubbin LD, Liebenberg L, Jiménez JAV, Rivera-Rivera L, et al. Validity and reliability of the Mexican resilience measurement scale in families of children with chronic conditions. <i>Health Qual Life Outcomes</i> . 2017;15:242.
Pain Resilience Scale	Not applicable to study population; for use in individuals experiencing physical pain.	Slepian PM, Ankawi B, Himawan LK, France CR. Development and initial validation of the Pain Resilience Scale. <i>J Pain</i> . 2016;17(4):462-472.
Predictive 6-Factor Resilience Scale	General measure of resilience rather than focused on academic resilience.	Rossouw PJ, Rossouw JG. The predictive 6-factor resilience scale: neurobiological fundamentals and organizational application. <i>Int J Neuropsychotherapy</i> . 2016;4(1):31-45.
Resilience Questionnaire for Bipolar Disorder	Not applicable to study population; for use in individuals diagnosed with bipolar disorder.	Echezarraga A, Las Hayas C, Gonzalez-Pinto AM, Jones S. The Resilience Questionnaire for Bipolar Disorder: development and validation. <i>Arch Psychiatr Nurs</i> . 2017;31(4):376-385.
Resilience Scale	General measure of resilience rather than focused on academic resilience.	Wagnild GM, Young HM. Development and psychometric evaluation of the Resilience Scale. <i>J Nurs Meas</i> . 1993;1(2):165-178.
Resilience Scale for Adolescents	General measure of resilience in adolescents rather than focused on academic resilience.	Hjemdal O, Friborg O, Stiles TC, Martinussen M, Rosenvinge JH. A new rating scale for adolescent resilience: grasping the central protective resources behind healthy development. <i>Meas Eval Couns Dev</i> . 2006;39:84-96.
Resilience Scale for Adults	General measure of resilience rather than focused on academic resilience.	Hjemdal O, Friborg O, Martinussen M, Rosenvinge JH. Preliminary results from the development and validation of a Norwegian scale for measuring adult resilience. <i>J Norwegian Psychol Assoc</i> . 2001;38(4):310-317. Friborg O, Hjemdal O, Rosenvinge JH, Martinussen M. A new rating scale for adult resilience: what are the central protective resources behind healthy adjustment? <i>Int J Methods Psychiatr Res</i> . 2003;12(2):65-76. Friborg O, Barlaug D, Martinussen M, Rosenvinge JH, Hjemdal O. Resilience in relation to personality and intelligence. <i>Int J Methods Psychiatr Res</i> . 2005;14(1):29-42.
Resilience in Midlife Scale	Not applicable to study population; designed to measure resilience in midlife individuals (ages 35-60 years).	Ryan L, Caltabiano ML. Development of a new resilience scale: the Resilience in Midlife Scale (RIM Scale). <i>Asian Soc Sci</i> . 2009;5(11):39-51.
Resilience at Work Team Scale	Not applicable to study; focused on resilience in work-based teams rather than individuals.	McEwen K, Boyd CM. A measure of team resilience: developing the Resilience at Work Team Scale. <i>J Occup Environ Med</i> . 2017. doi: 10.1097/JOM.0000000000001223

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Appendix 1. (Continued)

Scale	Reason Scale was Not Selected for Study	Key Reference(s) <sup>a</sup>
Resiliency Scales for Children and Adolescents	Not applicable to study population; designed to profile personal strengths and vulnerabilities in children/adolescents ages 9-18 years.	Prince-Embury S. <i>Resiliency Scales for Children and Adolescents: A profile of personal strengths</i> . San Antonio, TX: Harcourt Assessment, Inc.; 2007.
Scale of Protective Factors	General measure of resilience rather than focused on academic resilience.	Ponce-Garcia E, Madewell AN, Kennison SM. The development of the Scale of Protective Factors: resilience in a violent trauma sample. <i>Violence Vict.</i> 2015;30(5):735-755.
Trauma Resilience Scale	Not applicable to study population; for use in individuals who have experienced interpersonal violence, threatening situation/injury or other traumatic event.	Madsen MD, Abell N. Trauma Resilience Scale: validation of protective factors associated with adaptation following violence. <i>Res Soc Work Pract.</i> 2010;20(2):223-233.
Trauma Resilience Scale for Children	Not applicable to study population; for use in children who have experienced interpersonal violence, threatening situation/injury or other traumatic event.	Thompson MDM. <i>Trauma Resilience Scale for Children: Validation of Protective Factors Associated with Positive Adaptation Following Violence</i> [dissertation]. Tallahassee, Florida: Florida State University, 2010. <a href="http://purl.flvc.org/fsu/fd/FSU_migr_etd-1398">http://purl.flvc.org/fsu/fd/FSU_migr_etd-1398</a> . Accessed July 24, 2019.
Walsh Family Resilience Questionnaire	Not applicable to study population; for use in assessing resilience in families.	Walsh F. <i>Strengthening Family Resilience</i> . New York: Guilford Press; 1998. Walsh F. Family resilience: a framework for clinical practice. <i>Fam Process.</i> 2003;42(1):1-18. Walsh F. <i>Strengthening Family Resilience</i> . 3 <sup>rd</sup> edition. New York: Guilford Press; 2016.
Youth Resilience Measure	General measure of resilience (includes quantitative and qualitative components) in young adults rather than focused on academic resilience.	Ghimbulut O, Opre A. Assessing resilience using mixed methods: Youth Resilience Measure. <i>Procedia - Soc Beh Sci.</i> 2013;78:310-314.

<sup>a</sup> Several scales have shortened versions and/or translations in multiple languages. For ease of review, this appendix is limited to original or key reference(s) concerning development/psychometric testing of each scale

Appendix 2. Adapted 30-item Academic Resilience Scale, Rated According to Likert Scale from 1=Unlikely to 5=Likely

**DIRECTIONS:** Please read the vignette below, imagining yourself as the student in the story. Then review the survey items and check the response which best reflects your opinion of each item based on your reactions to the vignette.

**Vignette**

You received an 'F' on your most recent pharmacy course exam. The grades for two other recent exams in the same course were lower than you would want. You are concerned these grades will jeopardize your academic standing and progression in the short-term, as well as your long-term goal of getting a residency after graduation. The feedback you have received from your instructors is quite critical, such as reference to 'lack of understanding' and 'poor preparation,' but also includes suggestions to improve your exam performance.

- |                                                                                                      |
|------------------------------------------------------------------------------------------------------|
| 1. I would not accept the instructors' feedback. <sup>a</sup>                                        |
| 2. I would use the feedback to improve my exam performance.                                          |
| 3. I would just give up. <sup>a</sup>                                                                |
| 4. I would use the situation to motivate myself.                                                     |
| 5. I would change my career plans. <sup>a</sup>                                                      |
| 6. I would probably get annoyed. <sup>a</sup>                                                        |
| 7. I would begin to doubt my chances of success in the PharmD program. <sup>a</sup>                  |
| 8. I would see the situation as a challenge.                                                         |
| 9. I would do my best to stop thinking negative thoughts.                                            |
| 10. I would see the situation as temporary.                                                          |
| 11. I would work harder.                                                                             |
| 12. I would probably get depressed. <sup>a</sup>                                                     |
| 13. I would try to think of new solutions.                                                           |
| 14. I would be very disappointed. <sup>a</sup>                                                       |
| 15. I would blame the instructor(s). <sup>a</sup>                                                    |
| 16. I would keep trying.                                                                             |
| 17. I would not change my long-term goals and ambitions.                                             |
| 18. I would use my past successes to help motivate myself.                                           |
| 19. I would begin to think my chances of getting the job or residency I want were poor. <sup>a</sup> |
| 20. I would start to monitor and evaluate my achievements and effort.                                |
| 21. I would seek help from my instructors.                                                           |
| 22. I would give myself encouragement.                                                               |
| 23. I would stop myself from panicking.                                                              |
| 24. I would try different ways to study.                                                             |
| 25. I would set my own goals for achievements.                                                       |
| 26. I would seek encouragement from my family and friends.                                           |
| 27. I would try to think about my strengths and weaknesses to help me work better.                   |
| 28. I would feel like everything was ruined and going wrong. <sup>a</sup>                            |
| 29. I would start to self-impose rewards and punishments depending on my performance.                |
| 30. I would look forward to showing that I can improve my grades.                                    |

<sup>a</sup> Indicates reverse-scored items

Appendix 3. Short Grit Scale, Rated According to Likert Scale from 1=Not Like Me at All to 5=Very Much Like Me

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**DIRECTIONS:** Please review the items below and check the response which best reflects your opinion of each item.

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1. New ideas and projects sometimes distract me from the previous ones.
  2. Setbacks don't discourage me.
  3. I have been obsessed with a certain idea or project for a short time but later lost interest.
  4. I am a hard worker.
  5. I often set a goal but later choose to pursue a different one.
  6. I have difficulty maintaining my focus on projects that take more than a few months to complete.
  7. I finish whatever I begin.
  8. I am diligent.
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